WEST AFRICAN CACAO RESEARCH INSTITUTE

QUARTERLY PROGRESS REPORT

No. 34

TAFO, GOLD COAST.

WEST AFRICAN CACAO RESEARCH INSTITUTE
TAFO

THIRTY-FOURTH QUARTERLY REPORT : APRIL-JUNE, 1954

SENIOR STAFF

Director	... J. West (On leave April 27th)
Deputy Director	... A. Pickles
Division of Entomology	... J. Nicol (On leave 28/5/54) ... H.R. Mapother ... P.B. Cornwell (Returned 19/5/54) ... D.J. Taylor ... F.E. Decker
Division of Pathology	... W.T. Dale ... T.W. Tinsley ... A.L. Wharton (Returned 4/5/54) ... G. Usher
Division of Botany	... J.F. Archibald ... H.H. Rogers ... R. Knight ... A.D. McKelvie
Division of Soil Science and Chemistry	... J.A.R. MacLean (On leave 31/3/54) ... S.N. Adams (On leave 12/5/54)
Division of Agronomy	... R.J. Bonstead (On leave 26/5/54) ... R. Wickens
Nigerian Sub-Station	... R.G. Donald ... R.M. Lister (On leave 22/3/54) ... J.M. Thresh
Maintenance Engineer	... C. Alderson, D.S.O.
Station Manager	... S.E.N. Kwafo
Secretary	... C.H. Neal

STAFF

Mr. J. West, Director, went on vacation leave, prior to retirement, on the 27th April and Mr. A. Pickles was appointed Acting Director.

VISITORS

Visitors to the Institute during the quarter included Dr. C.B. Williams, F.R.S., who came on the invitation of the Managing Committee to advise on capsid research; the Hon. K.O. Mbadiwe, Minister of Lands and Natural Resources, Lagos and the Permanent Secretary to the Ministry; Mr. Mason Sears of the Togoland Trusteeship Council; the members of the Civil Service Training Mission; Mr. Lloyd Owen of Messrs. Rowntree Ltd.; Professor H.W. Miles, of the South Eastern Agricultural College, Wye; Dr. J.B. Danquah; Mr. K. Boadu, of the Gold Coast Cocoa Marketing Company, London and Mr. C. Morley, Special Commissioner for Development Corporations and Marketing Boards; Dr. E.B. Worthington, Secretary-General of the Scientific Council for Africa South of the Sahara; Mr. S.J.E. Southgate, Chairman of the Managing Committee.

MANAGING COMITTEE /

MANAGING COMMITTEE

Mr. S.J.E. Southgate, Chairman of the Managing Committee, assumed office as Chief Secretary, West African Inter-Territorial Secretariat on the 16th June.

The membership of the Committee was modified by the West African Cocoa Research (Amendment) Ordinance, 1954, which increased the number of Gold Coast Government representatives on the Committee to five, two of whom shall be members of the Cocoa Marketing Board.

DIVISION OF AGRONOMY

TAFO STATION

(a) Cacao Areas

Seedling and mature cacao areas have been brushed through as part of the routine seasonal work. Pruning of capsid damaged and dead twigs, removal of black pods, wilted cherelles and parasitic plants has been carried out. Negligible quantities of crop have been offering and it is anticipated that the mid-crop will be later than usual, although heavy.

(b) New Plantings

Three areas of land have been planted with seedling and clonal cacao during the latter part of June. These areas comprise the following :-

(i) Seedling vs. Cutting Experiment : Planting material derived from both hand-pollinated pods and two-leaf fan cuttings of representative selections of Amelonado (A.196) hybrid (TF.1) and Amazon (T.60) types of cacao have been planted in the form of the first replicate of a split-plot experiment. Three spacings, appropriate to high, medium, and low density for each type, have been used. Two more replicates are required and will, it is hoped, be planted in 1955.

(ii) Clonal block for a pruning experiment: The two acres of land on the Square Mile previously known as the "N.38 plot" has been cleared of the few remaining cacao seedlings and replanted with blocks of cuttings at 11' x 11' (approximately) quincunx spacing for a future comparison of growth and yield when chupons are encouraged or removed from fan cuttings. The types used in the "Seedling vs. Cutting Experiment" are represented here with the addition of a further Amelonado R.15.

(iii) Six-acre block of mixed Amazon bare root seedlings: This is to serve a dual purpose of providing an area of regularly spaced seedling cacao for future experiments and also as a large scale test of the reliability of the transplanting technique (fork lifting of 4-5 month old seedlings) adjudged the best from previous experiments.

(c) Swollen Shoot Disease

The frequency of tree inspection on the Old Station was increased during the quarter by doubling the number of Assistants engaged on this work. The table shows losses during the quarter :-

TABLE I /

TABLE I

Month	Old Station			Square Mile			
	Diseased	Other causes	Total	Diseased	Suspect	Contact	Total
April	36	18	54	255	48	76	379
May	79	26	105	249	46	54	349
June	58	20	78	145	56	91	292
Total	173	64	237	649	150	221	1,020

(d) Capsid Control

Routine hand-painting of all young cacao continued until mid-May when the heavy rains began. A total quantity of 4.7 gallons DDT concentrate was used on 120,000 plants. Capsid control measures on the Old Station have been stepped up, firstly by the introduction of routine DDT dusting at approximately four-monthly intervals and the coppicing of several areas of "Capsid pockets". The cacao in these areas shows a wide range of girth measurement and is situated on a variety of soil types. Records of the dates of chupon emanations will be kept in an attempt to discover any associations with girth and soil type. Similar dusting and coppicing operations are being undertaken in the 1st P.T.A., now handed over by the Plant Breeders to this Division for maintenance as routine cacao.

SUB-STATIONS

As on the main station, seasonal work with the addition of shade thinning, has proceeded during the quarter. Similarly the pickings of off-season cacao have been negligible and a late but heavy mid-crop is expected. All plots at Akwadum have been assessed in respect of capsid damage and according to the results will either be subjected to the same dusting routine as is now in operation on the Old Station, or coppiced if a sufficient stand remains, or on those plots which show only a sparse stand of damaged cacao this will be removed altogether.

Incidence of Swollen Shoot Disease is shown in the table :-

TABLE II

Station	Number of trees
Adonkwanta	35 (inc. 33 seedlings)
Akwadum	1
Nankese	Nil
Kukua	2
Koransang	Nil

METEOROLOGY

Rainfall for all stations is given below :-

TABLE III /

TABLE III

Station	Rainfall in ins.				Wet days			
	April	May	June	Total	April	May	June	Total
Tafo 1954	7.26	6.45	8.17	21.88	13	14	21	48
" (16-yr. mean)	5.72	6.96	8.45	21.13	11.1	13.4	18.3	42.8
Adonkwanta	12.66	6.83	7.24	26.73	14	14	16	44
Akwadum	5.97	8.77	5.86	20.60	14	16	10	40
Nankese	9.48	4.75	6.21	20.44	12	9	7	28
Kukua	9.87	5.70	8.78	24.35	10	8	10	28
Koransang	8.06	6.20	8.13	22.39	13	10	8	31

DIVISION OF ENTOMOLOGY

CAPSID INVESTIGATIONS

Work has continued on the effect of the various factors, including those of climate, inter-specific relationships, and fruiting on the fluctuations of capsid populations. These observations will have to cover at least one annual cycle before any conclusions can be drawn.

POPULATION SAMPLING

The use of light-traps as a method of population sampling has been investigated. Various light traps have been tried including the Rothamsted trap and a modified version of the Robinson trap. The latter, incorporating a 500 watt ultra-violet bulb, was found to be the most effective in trapping capsids. This method of sampling is being continued to see whether the population trends indicated are similar to those obtained from the Routine Collections.

CAPSID/CALONECTRIA CONTROL

The results so far obtained have not indicated that combined insecticidal/fungicidal sprays are more effective than insecticides alone in the control of capsid/calonectria damage.

CAPSID CONTROL

Experiments have been commenced at Tafo and Akwadum comparing the efficiency of the local standard capsid control measures with those used in the Belgian Congo, namely, regular inspection and localised treatment with insecticidal dust on trees showing evidence of recent damage. As this latter method also involves the removal of all chupons after the formation of the first jorquette, the experiments have been designed, in conjunction with the Division of Agronomy, to include the investigation of any effects this pruning may have on yield.

This method of control is also being applied to a two-acre observation plot in order to obtain an estimate of the cost.

CHEMICAL CONTROL OF CAPSIDS ON INTERMEDIATE CACAO

The large scale trial at Nankese Sub-station continues with capsid counts and assessment of capsid-

damaged /

damaged shoots at monthly intervals. The last treatment was applied in February 1954 and the next will be in July 1954.

A small trial has been initiated to find whether overall spraying with DDT emulsion can cause damage to foliage at any time during the seasonal growth of cacao trees.

BIOLOGICAL CONTROL OF MEALYBUGS

Shipments of introduced parasites from California have consisted only of Anagyrus pseudococci. Supplies of the other species ceased to arrive in January.

29,081 Pseudaphycus angelicus, 8,340 P. mundus and 4,565 Anagyrus pseudococci, a total of 41,986 parasites, have been liberated during the present quarter in the Old Station.

Intensive collections of mealybugs from the release areas outside Tafo have been carried out and so far no introduced parasite has been recovered.

MEALYBUG STUDIES

The experiment to determine differences in mealybug populations on cacao trees growing in bush and on trees in well cultivated areas has continued. Data recorded over the first six months of this year suggest that the mealybug and predator populations on trees in the bush plots exceed those recorded on the trees in well cultivated areas.

SYSTEMIC INSECTICIDES

Monthly re-inspections of the Atukrom experimental plot continue with mealybug counts being made on all trees found diseased. Counts are made in conjunction with Messrs. Pest Control Ltd. The number of mealybugs found continues to be small.

WACRI SUB-STATION, NIGERIA

Natural Enemies of Mealybugs

One specimen of an Encyrtid parasite not represented in the W.A.C.R.I. collection and an unknown species of Hyperaspis (Coccinellidae) have been reared from colonies of Planococcus citri (Risso). Leptomastix bifasciatus Compere has been recorded from Pseudococcus concavocerarii James. An undetermined hymenopterous parasite, previously believed to attack mealybugs in both the Gold Coast and Nigeria, has been found to emerge from pupae of predacious Cecidomyiidae. One hundred and forty adult Cecidomyiidae, all reared from predacious larvae, have been despatched for identification.

Mealybug Population

Owing to the difficulty of obtaining mature cacao trees which may be cut down for detailed counts of mealybugs, it was decided that, when treatment of the newly discovered outbreak of Swollen Shoot Disease at I.N.A. cacao farm was begun, efforts should be concentrated for a week or so on detailed mealybug counts there. These will

continue /

continue into the next quarter. The main object of these counts is to estimate the correlation, if any, between the mealybug population observed from ground level and the actual population of mealybugs on the trees.

DIVISION OF PLANT PATHOLOGY

VIRUS RESEARCH IN THE GOLD COAST

Host Range Studies

Two more species of Theobroma have proved to be susceptible to cacao swollen shoot virus in laboratory tests; Th. obovata Bern. has been infected by the New Juaben, Kpeve and Offa Igbo strains, and Th. angustifolia DC. by the New Juaben strain.

Two trees of Adansonia digitata Linn., a constituent of the savannah flora of the Gold Coast, have been found to be naturally infected with a virus which can be transmitted to cacao by the mealybug Pseudococcus njalensis Laing. These trees occur on the Accra Plains near Dodowah. Surveys are being made to determine the extent of infection in the Gold Coast. It is not yet known if this virus is related to any of those of the cacao swollen shoot complex; but its symptoms, though very mild in cacao, appear to follow the same phases. Infected Adansonia digitata have small leaves with light green or yellow blotches.

The Chemical Test for Swollen Shoot Disease Diagnosis

A survey of swollen shoot infection in the WACRI Old Station cacao has been started, using this test. Results so far obtained suggest that the method can be used on a small scale for diagnosing symptomless infection in the field, provided its limitations are appreciated. Anomalous results with types of cacao other than Amelonado seem to be associated, in most instances, with high tannin content of the leaves; healthy plants with a high tannin content gave a deep red colour, comparable with that given by infected Amelonado.

Analyses of the leaves of Amelonado seedlings infected by the New Juaben strain have shown that the tannin content of areas affected by the "fern-leaf" symptom is higher than that of the green parts. Comparable leaves from healthy plants have less tannin than the "fern-leaf" areas of diseased leaves, but more than the green parts.

Amelonado seedlings about 6 weeks old were "bombarded" with mealybugs that had fed on material infected by the New Juaben strain. Infection was diagnosed 10 days later by applying the chemical test to the leaf immediately below the feeding site, but no visible symptoms appeared for a further 15 days.

Virus-Vector Relations

Investigations into the effect of different test-feeding times on infection rate, using the New Juaben strain and Pseudococcus njalensis, have been continued. When the number of mealybugs was reduced to two per test bean, the results were more variable than with five (see previous Quarterly Report). A test-feeding period of 2 hours again gave the lowest infection rate (33%), but those for the longer periods ranged from 39% (8 and 64-hour feeds) to

55% /

55% (16-hour feed). There is no obvious reason why a 16-hour test feed should give better results than longer ones, and this experiment will be repeated to find out if there are genuine differences. With test-feeding periods of $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, 1, 2 and 4-hour, the infection rates increased progressively from 0 to 52%.

These experiments and the one previously reported suggest that although P.njalensis can transmit the virus to cacao cotyledons in as little as $\frac{1}{2}$-hour, periods up to 4-hour (and possibly longer) will give higher infection rates, perhaps largely because the likelihood of settling is increased.

The effect of different source-feeding times is also under investigation. In an initial experiment, preliminary starving and test-feeding times of 18 and 8-hour respectively were employed with source-feeding times of 2, 4, 8, 16, 32 and 64-hour. Six source plants were used, each one being assigned in turn to each of the six source-feeding treatments, to minimise the effect of variation in virus concentration from plant to plant. The experiment is not quite complete, but it would appear that the infection rate rises to a peak, corresponding to about 16-hour source-feeding, and then falls off.

Effect of Host Nutrition on Symptomatology

The two water culture experiments to determine the effects of nutrient deficiency and excess on the symptomatology of the virulent New Juaben virus, carried out in collaboration with the Soil Chemist (see previous Quarterly Report, Soil Science Section), have been completed. The results are now being analysed and will be summarized in the next Report.

Other Projects

Studies on the inter-relationships of strains of the swollen shoot virus complex, utilising the phenomenon of cross-protection, are continuing. Multiplication of the New Juaben, Bisa, Mampong, Bosomtwe, Bosomuoso, Kpeve, Alaparun and Offa Igbo strains in excised cacao cotyledons is being compared.

Further attempts to transmit swollen shoot disease from infected to healthy cacao plants by hypodermic injection and leaf rubbing, using celite as an abrasive, were unsuccessful; as was also an attempt to render mealybugs (Pseudococcus njalensis) infective by inoculating them with juice from infected plants, using a fine glass needle. In both experiments, inoculum was prepared by macerating 10 gm. of leaf tissue in 25 ml. of distilled water, squeezing through muslin, and centrifuging the resulting extract at 8,000 r.p.m. for 2 min.

VIRUS RESEARCH IN NIGERIA

The Offa Igbo Observation Plot

The number of cacao trees in this plot showing virus symptoms has increased each month, although the rate of increase was reduced during the dry season. At each recording, trees can be found with leaf symptoms or swellings only, but the majority show both; although with new infections swellings are usually preceded by vein-banding or mottling of the leaves. At each inspection a small number of trees appear healthy, in spite of having been

previously /

previously observed with symptoms.

Results of Monthly Surveys, 1953-54

	Total Number of Trees	Number Infected	New Infections
October ...	290	30	13
November ...	290	39	9
December ...	290	50	11
January ...	287	55	5
February ...	287	64	9
March ...	287	78	14
April ...	286	95	17
May ...	286	109	14

The number of seedlings in the insectary showing symptoms after grafting with material from the Offa Igbo trees has risen to 35. A number of the grafts have had to be repeated due to failure.

Coppicing Experiments

Regeneration is progressing satisfactorily on each of the swollen shoot infected areas which were coppiced, in March, instead of receiving the usual "blocking out" treatment. It was sufficiently advanced 14 weeks after cutting for symptom observations to be made.

Although additional chupons on regenerating stumps may perhaps show infection at a later date, it seems probable that the original inspection of Area 1 (Abudoro) revealed all the infected trees; two isolated ones and a group of ten occurred in a block of 1,132 trees. At area 2 (Agunmu) eight apparently healthy trees were actually infected at the time of coppicing, all being in contact with or adjacent to a group of five trees showing symptoms. With infection scattered throughout the whole of the small farm, 19 of the 26 trees at Area 3 (Agunmu) were infected at the time of coppicing, although only 13 were showing symptoms.

Additional coppicing experiments are to be carried out in association with the Cacao Survey Division, who have already treated one small area on the Ibadan - Oyo road. These experiments should give valuable information on the pattern of natural spread of virus under Nigerian conditions, and may lead to more efficient control methods.

Newly Reported Outbreaks

Routine testing of material brought in by the Cacao Survey Division has continued, and an isolate has recently been made from a newly reported outbreak in one of the experimental plots of the Ibadan Native Administration (I.N.A.) farm. The extent of infection and the presence of large swellings on old wood indicate that some of the trees have been infected for quite a long time. The W.A.C.R.I. Sub-station has taken responsibility for treating the area, in which symptom-bearing trees will be cut out and adjacent ones coppiced. If the area involved proves to be sufficiently large, it may be possible to investigate regeneration under different shade conditions.

Host Range Investigations

Shortage of mealybugs is seriously limiting this work and the position has been further complicated by the

discovery of virus in the mealybug collecting area at I.N.A.

Adansonia digitata and Bombax buonopozense have each been shown to be susceptible to the Olanla and Ilesha isolates of cacao swollen shoot virus, and Ceiba pentandra is susceptible to the latter. It is hoped to increase the scope of testing for natural infection in wild species known to be susceptible to the virus.

Attempted Mechanical Transmission and Inhibitor Studies

Water extracts of infected cacao leaves, from which tannin materials had been extracted, failed to give mechanical transmission of swollen shoot disease.

A culture of tobacco mosaic virus (isolated from a plantation of the Nigerian Tobacco Company) is being built up for use in studies on the virus-inhibiting properties of cacao extracts.

MYCOLOGY - BLACK-POD DISEASE

Fungicide Control Trials

Harvesting treatments in the Black-Pod Disease Control Trial (Trial I) laid down at Bunso Plantation last year have been continued. The infrequent harvesting treatment was changed from three-weekly to monthly in August, 1953, so that it would fit in more conveniently with the monthly and two-monthly spraying programmes, which began on 20th May, 1954.

A second spraying trial (Trial II) has been started on Cacao Area 14 at Bunso Plantations. This includes two fungicides, 'Perenox' and 'Blitox', applied at fortnightly and monthly intervals, combined with frequent (weekly) and infrequent (monthly) harvesting. Spraying was begun on the 26th May, 1954. The original intention of using dust treatments for this trial (see 29th Quarterly Report) was abandoned because the area proved too small to permit the spacing of plots wide enough to avoid drift effects.

Cushion Infection Studies

Last crop season, complete records of the pods borne on 1,000 labelled cushions were obtained. So far this year only 52 of these have set fruit. Moreover, of this number, only 17 bore healthy mature pods last season and are bearing healthy pods now. This season's crop on the trees concerned has been set almost entirely on cushions which were not bearing last year. The cushions on these trees may be bearing biennially, and observations will have to be continued in future years.

Resistance Tests

The testing of selections of cacao and other Theobroma species for resistance to the disease, by artificial inoculation of pods in the field, is being undertaken in conjunction with the Plant Breeding Section of the Botany Division. Both intact and artificially wounded pods of Theobroma speciosa Spreng. were readily infected, but of the Amelonado cacao pods treated at the same time only wounded ones developed the disease.

BOTANY DIVISION

VEGETATIVE PROPAGATION

Clonal Nursery

Tree cassava shade in the nursery was drastically reduced. The Gliricidia is now growing out to fill the space. Damage was also done to the shade trees by severe storms.

Flowers are being removed from the plants as part of the routine cultivation.

Routine Propagation

Cuttings were supplied to the Plant Breeders for use in the Bunso clonal plots, and to the Agronomist for planting up the first replicate of the Cuttings versus Seedlings trial and the new Pruned versus Unpruned Cuttings Trial.

Cuttings were taken from the Introductions for the source plants for the new 3rd. Clonal Trial. Further clones were established of selected types.

Experimental Propagation

The series of experiments on the effect of ringing petioles of single leaf cuttings in relation to the time of propagation has been completed, but the results have not yet been analysed.

Experiments on rooting cuttings in nursery beds under wooden frames suffered from flooding, with the loss of most of the cuttings when they were being hardened. A further series was laid down which is still in progress.

Controlled Growth of Cuttings in the Field

A small experiment on various methods of training young clonal plants in the field is to be planted up in the area formerly occupied by the Amelonado-Amazon demonstration.

TISSUE CULTURE

No new work has been started during the period on the culture of tissues in vitro.

VIRUS TRANSMISSION BY EMBRYO GRAFTING

Tests were carried out on different methods of implanting infected tissue into cacao embryos to obtain virus transmissions. The most successful technique was to insert the implant into a slit made in the hypocotyl, and to incubate the embryo for six days before planting. Although the number of transmissions using this method was very low (2/50) the ease and speed with which the grafts could be made tended to compensate for this.

Experiments are to be carried out to try and obtain transmissions from bark explants cultured in vitro.

BIOLOGICAL ASSAY OF GROWTH SUBSTANCES

Experiments on the assay of naturally occurring growth substances were continued, and the technique described

previously /

previously has been refined to detect β indole acetic acid at one part in 10^{-8}. The method is being applied to the detection of growth substances separated by paper partition chromatography.

GERMINATION OF CACAO BEANS

Further experiments on the germination of cacao beans showed that :-

(1) Germination was not impeded mechanically by the seedcoat.

(2) Although the seedcoat may have prevented free gaseous exchange between the embryo and the external air, the first stage of growth of the embryonic axis occurred under anaerobic conditions. Thus under normal conditions no stage of the embryo's growth was impeded by lack of free gaseous exchange because of the seed-coat, as the anaerobic stage was sufficient to carry a portion of the hypocotyl clear of the seedcoat.

(3) Under anaerobic conditions growth of the hypocotyl took place until the tip had protruded about 10 m.m. from the cotyledons: growth then ceased. A week after the growth of the cotyledons had ceased the beans were returned to aerobic conditions and growth continued as if there had been no interruption. This effect is being studied further in view of its possible importance to the storing of planting material.

(4) A substance which inhibited the growth of embryo cylinders in the standard test described previously was present in the testa and adhering pulp of cacao beans. Tests are now being carried out using different methods of extraction, on testas, cotyledons and embryo axes from beans at all stages of maturity.

PHOTOPERIODISM

A small experiment was laid down to test the effect of altering the day length of fan cuttings which had rooted. One set of cuttings was kept under continuous light conditions: diffused daylight complemented by four 75 watt incandescent bulbs at night. Another set of plants received eight hours daylight only; at 1530 they were covered with opaque paper hoods which were removed at 0730. No temperature differences were found between the two sets of conditions. After two weeks continuous light a number of the plants was completely defoliated and on the remainder the leaves were dead or dying: although the water supply was adequate throughout the effect was one of extreme drought. The plants receiving an eight hour day appeared normal.

The experiment is being repeated using clonal chupon plants and the effect of the treatment will be followed for some months.

PLANT BREEDING

Established Trials

Shade thinning has been completed in all trial areas. Storms caused damage to both the Introductions

area /

area and the Clonal Trials during April.

The crop for the quarter from all trials is the lowest since 1950. Prospects for the mid-crop are good but it appears that the main crop will be late.

The 9th P.T.A. was planted in the field during the period 10th - 15th May. The progeny of nine crosses between the highest yielding Upper Amazon and Gold Coast selections at W.A.C.R.I. are to be compared with a standard selfed Amelonado. There are five replications of the ten selections.

Swollen Shoot Control

The spread of swollen shoot continues and the situation is becoming serious. For the first time C.S.S.V. has been recorded in the Clonal Trials and one new outbreak in the 'Observations Plot' adjacent to the new 8th P.T.A. Infected stands in the First P.T.A. include both contact trees and new single tree outbreaks. 106 trees have been removed this quarter.

Cytogenetics

Forms of Theobroma cacao have been produced with twice the normal number of chromosomes for this species (x = 10) by treating the plants with the drug colchicine. The plants were treated in October and the most recent flush leaves of some of the plants were found to have 40 chromosomes. The technique is being perfected and the plants arising from the treatment intensively studied.

Good flowering during the quarter has allowed further progress with incompatibility studies and pollination studies at Bunso. The 5-acre plot of self-incompatible E1 at Bunso is yielding interesting results. A spot plan has been prepared of all natural sets and from the grouping of these sets it is possible to trace the centre of 'pollen contamination'. Cases of cross-compatibility within the plot have been detected. A detailed account of the investigation will be given when the observations have been completed.

Department of Agriculture plots, Gold Coast

A second variety trial has been planted at Bunso. 627 seedlings were supplied for this trial.

A report prepared on the yields of Upper Amazon types on Department plots showed differences between areas and between generations. The Department yields are lower than those from the Introductions plot at Tafo.

Despatch of Material

The distribution of cutting material, beans and pods continues.

752 cuttings have been supplied for the new clone collections at Poanu and Juaso. The Western Region Development Board, Nigeria, are to receive the whole of the crop from ten types of Upper Amazons. 281 pods have been despatched this quarter. The 7th consignment of beans to Liberia and the 1st consignment to the French Ivory Coast have been sent.

PLANT PHYSIOLOGY

Cherelle Wilt

The routine measurements of pod growth continued throughout the quarter. The same type of sigmoid growth curve occurs in Amelonado, Trinitario and Amazon selections. Two growing periods have now been observed in the developing pod. During Period I the pod enlarges rapidly and the integuments develop but the embryo remains small. During Period II the growth of the pod becomes slower and the embryo develops rapidly. This second period normally begins about 100 days after pollination. At the end of Period II, ripening commences.

The regular geometrical shape of the cacao pod and its practically unchanged shape during development have enabled pod volume to be calculated from linear dimensions.

Recording of wilt incidence was continued. The percentage wilt increased steadily from March to May then fell sharply in June as no new pods were formed and the older ones were past the wilting stage.

An experiment designed to test the effect of removing flush leaves on wilting, has shown a significant decrease in the amount of wilted pods when buds are removed before leaves open. The experiment is continuing to see whether this is purely a short-term effect or whether it will lead to an increase in yield.

Tests with α-naphthalene acetic acid have shown that flushing can be inhibited on seedlings up to six months old, using a concentration of 200 p.p.m.

A solution containing 50 p.p.m. of 2 - 4 dichlorophenoxy acetic acid was sprayed on to cacao pods in an attempt to reduce the amount of wilt. The only observable effect was a slight but insignificant increase in the amount of wilting.

Leaf Analysis

Work has commenced on the chemical analysis of leaves and pods. Methods have been worked out for sampling and ashing. Colorimetric analytical methods have been perfected for nitrogen, phosphorus, calcium, manganese and boron and work is proceeding on other nutrients.

Leaves from trees affected with secondary vein clearing disease (from the Cameroons) are being analysed in an attempt to diagnose any possible nutritional disorders.

Roots

The soil sterilisation experiment has been discontinued since the soil is no longer sterile. No further root excavations were carried out due to heavy rain, and to absence in the Cameroons and Nigeria during May.

SOIL SCIENCE AND CHEMISTRY DIVISION

Both the Senior Officers of the Division were on leave during the quarter.

In the Soil Science section, routine work was carried out on the fertilizer experiments.

In the Chemistry section, work continued on the analysis of cocoa beans, purple bean pigments and cacao mucilage.

No new work was commenced during the quarter.

ENK.